ENERGY NORTHWEST

P.O. Box 968 ■ Richland, Washington 99352-0968

July 26, 2000
GO2-00-129

Docket No. 50-397

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

Subject: **WNP-2, OPERATING LICENSE NPF-21, LICENSEE EVENT REPORT NO. 2000-003-00**

Transmitted herewith is Licensee Event Report No. 2000-003-00 for WNP-2. This report is submitted pursuant to 10 CFR 50.73 and is the follow-up to Event Report Number 37114. The enclosed report discusses items of reportability, corrective action taken, and action to preclude recurrence.

Should you have any questions or desire additional information regarding this matter, please call me or Mr. PJ Inserra at (509) 377-4147.

Respectfully,

GO Smith

GO Smith
Vice President, Generation
Mail Drop 927M

Attachment

cc: EW Merschoff - NRC-RIV
JS Cushing - NRC-NRR
INPO Records Center
NRC Sr. Resident Inspector - 927N (2)
DL Williams - BPA/1399
TC Poindexter - Winston & Strawn

IE22

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
WNP-2	50-397	1 OF 4

TITLE (4)

Unit Trip and Reactor Scram due to Protective Relay Control Circuit Failure

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV. NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
06	026	2000	2000	003	00	07	26	2000	FACILITY NAME	DOCKET NUMBER

OPERATING MODE	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
			20.402(b)		20.405(c)	X	50.73(a)(2)(iv)		73.71(b)
POWER LEVEL	100		20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)(c)		73.71(c)
			20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER
			20.405(a)(1)(iii)		50.73(a)(2)(i)(B)		50.73(a)(2)(viii)(A)		
			20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Jerral E. Rhoads, Principle Engineer	(509) 377-4298

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	EL	CBL2	Rome	Y		B	SO	PSV	Control Concepts, Inc	N

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED	MONTH	DAY	YEAR
YES (If yes, completed EXPECTED SUBMISSION DATE).	X	NO				

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

ABSTRACT:

At 0825 hours PDT on June 26, 2000, with the plant in Mode 1 at 100% power, WNP-2 experienced a Unit Trip. This resulted in the tripping of the 500 kV power circuit breakers and exciter breaker, tripping the station auxiliary breakers, closing of the breakers to supply offsite power from the startup transformer and tripping of the main turbine. The turbine trip in turn initiated a reactor SCRAM. The unit trip was initiated by a signal from the Main Generator and Transformer Overall Differential protection relaying.

Immediately after the reactor SCRAM, two main steam relief valves (MSRV) automatically opened on high pressure. Emergency operating procedures were entered on Reactor Pressure Vessel (RPV) low level (+13"), RPV Pressure High (1060 psig), Suppression Pool Level High, and subsequently Suppression Pool Temperature High. Main Steam Bypass Valve #1 (MS-V-160D) temporarily remained open causing the reactor pressure to decrease to approximately 500 psig. The reactor water level increased to level 8 resulting in a trip of the main feedpumps. The pressure decrease was controlled by operator action to close the Main Steam to Auxiliaries Isolation Valve (MS-V-146). The reactor cool down rate limit was not exceeded. Operators restored reactor level to within the normal shutdown limits by a controlled condensate booster pump injection and maintained subsequent reactor vessel level and pressure with the Start-up RPV Level Controller and MSRVs.

The cause of the Main Generator and Transformer Overall Differential protection relay trip was a short to ground in an unused tap of one of the 500 kV current transformer's (CT) secondary control circuit wiring. This caused an unbalanced phase current signal to be sent to the relay causing it to actuate.

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Event Description

At 0825 hours PDT on June 26, 2000, with the plant in Mode 1 at 100% power, WNP-2 experienced a Unit Trip. This resulted in the tripping of the 500 kV power circuit breakers [52] and exciter breaker [TL], tripping the station auxiliary breakers [EA], closing of the breakers to supply 230 kV offsite power from the startup transformer [EA], and tripping the main turbine [TA]. The turbine trip in turn initiated a reactor SCRAM. The unit trip was initiated by a signal from the Main Generator and Transformer Overall Differential protection relay E-RLY-87/OA/A [87]. There was no equipment known to be inoperable at the start of the event that contributed to the event. Immediately after the reactor SCRAM, all reactor control rods fully inserted, two main steam relief valves (MSRV) automatically opened on high pressure, both recirculation pumps [AD] tripped after the turbine governor valve fast closure through the End of Cycle-Recirculation Pump Trip and the main steam bypass valves opened, as expected. Emergency operating procedures were entered on Reactor Pressure Vessel (RPV) low level (+13"), RPV Pressure High (1060 psig), Suppression Pool Level High, and subsequently Suppression Pool Temperature High. Main Steam Bypass Valve #1 (MS-V-160D)[PCV] temporarily remained open for approximately 20 minutes causing the reactor pressure to decrease to approximately 500 psig. The reactor level subsequently increased to level 8 resulting in a trip of the main feedwater pumps [SK]. The pressure decrease was controlled by operator action to close the Main Steam to Auxiliaries Isolation Valve (MS-V-146) to the main steam bypass valves. The reactor's cool down rate limit of 100 degrees F/hour was not exceeded. Operators controlled pressure within a 500 psig to 600 psig band with the MSRVs. Operators restored reactor level to within the normal shutdown limits by a controlled condensate booster pump injection and the Start-up RPV Level Controller. Suppression pool cooling was established and a recirculation pump was started. Upon stabilizing plant conditions, the emergency operating procedures were exited.

Immediate Corrective Action

A Problem Evaluation Request (PER) was initiated for the unit trip and reactor SCRAM. Plant Management initiated an investigation to determine the exact details of the event. Additional PERs were written for the problems found.

Further Evaluation

The protection zone of E-RLY-87/OA/A includes the main generator [TA], main transformers [TR], isophase bus duct [IPBU], normal transformers [TR] and the bus duct [NSBU] to the secondary switchgear [SWGR]. The zone is divided into overlapping sub-zones, each individually protected for differential overcurrent. There was no differential current relay operation in any of these sub-zones.

Analysis of the E-RLY-87/OA/A (/B, /C) differential protective relay design, the data captured by the plant data information system [IF], the plant alarm typer [IQ], the plant oscillograph [OSG], and the Bonneville Power Administration ASHE substation's digital fault recorder [OSG] was used to support a determination that the plant did not experience a fault condition. This was confirmed by gas in oil analysis for the various transformers in the zone of E-RLY-87/OA/A (/B, /C) protection, and visual inspections of the isophase bus, main transformers, normal transformers, main generator, and associated protective relays and current transformers (CT)[XCT]. Subsequent activities involved limited major component functional testing. This analysis concluded that a non-fault-related operation of the E-RLY-87/OA/A relay occurred.

Further Evaluation (continued)

The E-RLY-87/OA/A (/B, /C) relay configuration is designed such that relay operation will result from a phase to phase fault in the protected zone. Plant design is such that a single-phase ground fault in the protected zone cannot generate sufficient current to initiate a differential trip signal due to the main generator's neutral grounding resistor design. Thus, had the plant experienced a multiple phase fault on the 25 kV or 500 kV export zone, at least two of the three overall differential relays would be expected to actuate. Also, the main generator and the auxiliary transformers each have component specific differential relaying that would be expected to actuate upon a faulted condition in their zone of coverage (which are all within the E-RLY-87/OA/A (/B, /C) zone of coverage). However, the actuation of only one differential relay, with no substantiating evidence of a fault, is indicative of spurious relay trip, a CT problem or a control-wiring problem.

The overall differential relays E-RLY-87/OA/A (/B, /C) were removed and tested to determine functionality and whether the relay setpoints had changed. Test results indicated the relays were calibrated and performed properly. The associated CTs were resistance checked to determine if any winding(s) had opened which could have contributed to the actuation. All winding measurements were satisfactory with no evidence of an anomaly.

The CTs were then meggered to ground to determine control wire insulation and CT integrity (i.e., was there any damage resulting in a current path to ground). Megger results for the main transformer C Phase CT revealed a ground path not included in the circuit design. Visual inspection and subsequent megger testing confirmed a damaged CT wire on one of the unused taps of the CT making contact with ground. The wiring is standard #12 awg THHN insulation manufactured by Rome. This effectively changed the CT performance by providing an additional path to ground. The location of the ground path was such that current signals to both relays E-RLY-87/OA/A and E-RLY-87/OA/C were affected. The engineering analysis concluded that operation of the E-RLY-87/OA/A was a likely result of a ground at this location. Once the unbalanced current signal was established, the protective relaying operated as designed and initiated a generator load rejection trip.

Root Cause

The root cause of the unit trip was determined to be a short to ground in an unused tap of the 500 kV CT's secondary control circuit wiring at E-TR-M3. The routing of the conductor through the condulet fitting at the transformer had an inadequate "installed" bend radius. The inadequate bend radius was caused by tension in the wiring around the inside edge of the condulet fitting causing pressure between the conductor insulation and the edge inside the condulet fitting. Over time, vibration associated with normal transformer operation caused insulation abrasion, which led to the break down of the wire insulation. This resulted in a circuit path to ground and the current signal to relay E-RLY-87/OA/A becoming unbalanced and initiating the differential current relay trip.

Further Corrective Action

The damaged wiring was repaired and the CT wiring reworked to assure proper bend radius and installation on E-TR-M3. The wiring to the CTs on the other in-service main transformers (E-TR-M1 and M4) were inspected. The wiring through the condulet fittings were properly installed and no indications of wire insulation abrasion were observed.

The cause of the failure of the main steam bypass valve to close was determined to be a failed arming solenoid [PSV] on the bypass valve actuator. Control Concepts, Inc manufactured the arming solenoid. The manufacturer model number is BM-502-1-023. The design of the control system is such that the arming solenoid valve is open above 20% power to arm fast opening of the normally closed bypass valve, when required. After initial bypass valve opening, the arming solenoid is designed to close allowing bypass valve position control by the turbine digital electro-hydraulic control system to respond to reactor pressure changes. Failure of the arming solenoid to close prevented proper operation of the bypass valve after initial fast opening. The arming solenoid valve was replaced and post maintenance testing performed. The other three bypass valves responded correctly during the plant transient and were also tested during troubleshooting activities assuring a similar condition did not exist. The subsequent inspection of the failed solenoid revealed evidence that the valve plunger had jammed, most likely due to inadequate manufacturing tolerances. There was no evidence of debris or significant internal contamination. The solenoid had been recently replaced during the spring 1999 fuel-savings shutdown as part of the plant preventive maintenance program. A previous failure of an arming solenoid valve failure on a bypass valve in 1993 was due to o-ring breakdown and debris blocking ports. No evidence of that failure mechanism was observed in this failure.

Assessment of Safety Consequences

Except for the failure of main steam bypass valve to cycle closed along with the other bypass valves, the plant responded as expected for a load rejection transient. There was no decrease of the Minimum Critical Power Ratio (MCPR) during the transient. Comparison of key plant data with the safety analysis parameters indicated that the assumptions in the accident analysis for a generator load rejection transient bound the actual event and the Safety Limit MCPR was not challenged during the transient.

After the unit trip and reactor SCRAM the operations crews correctly implemented the emergency operating procedures to mitigate the stuck open bypass valve #1 condition and to shutdown, stabilize, and maintain the plant in a safe condition. This event was within the bounds of the WNP-2 safety analysis. Accordingly, this event posed no threat to the safety of plant personnel or the public.

Similar Events

There have been no similar events within the past 5 years associated with a unit trip.